Feb. 28, 1961 L. F. WELANETZ 2,972,950

ROD TYPE EXPLOSIVE WARHEAD

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FIG. 1.

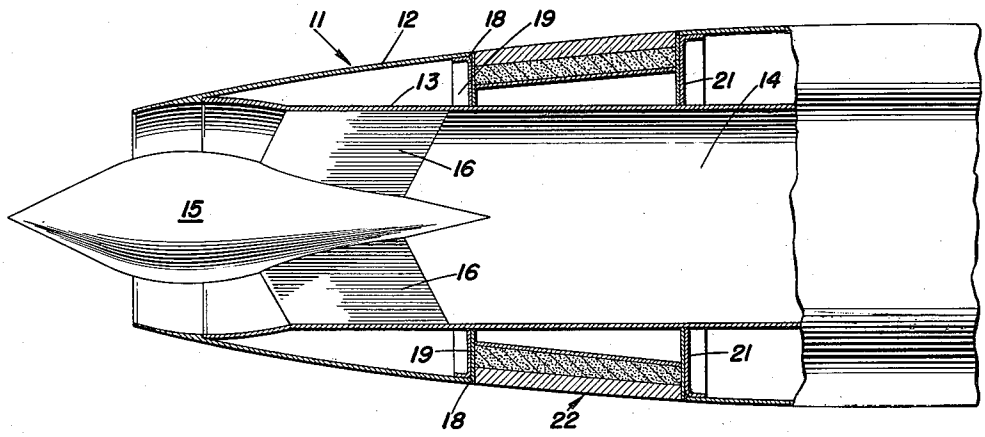

FIG. 2.

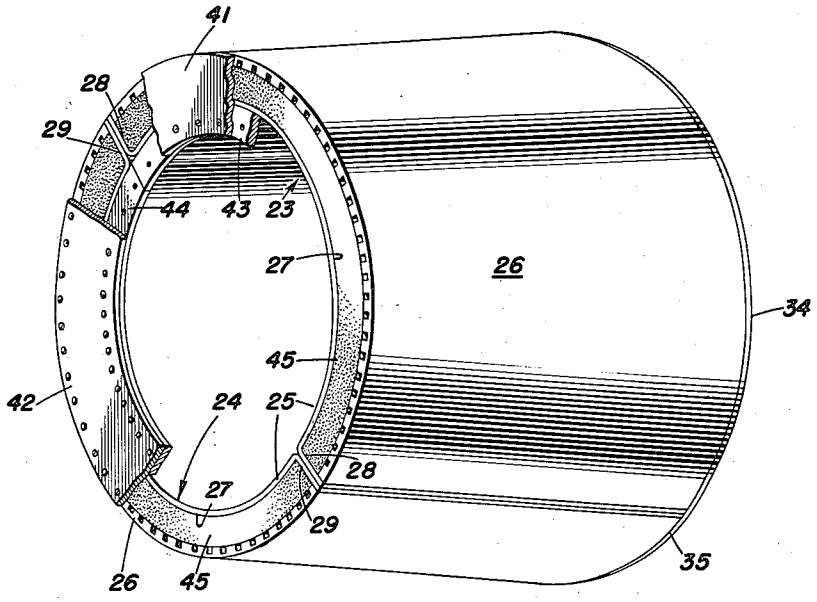

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FIG. 3.

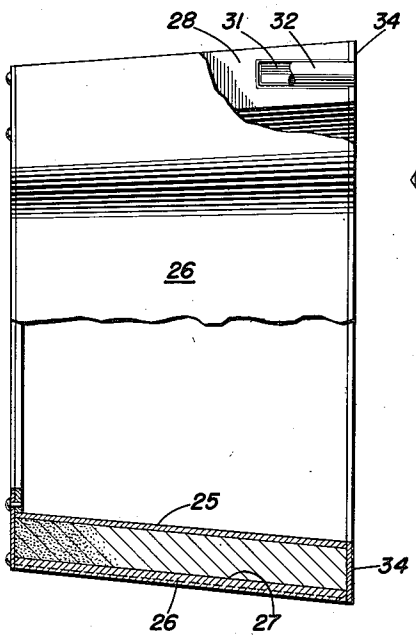


FIG. 4.

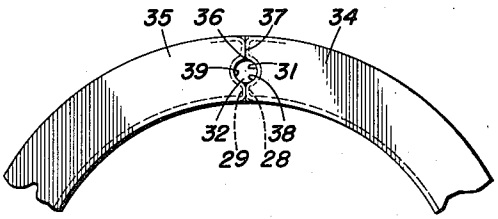


FIG. 6.

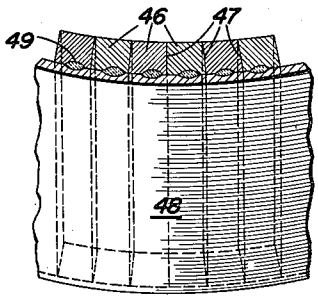


FIG. 5.

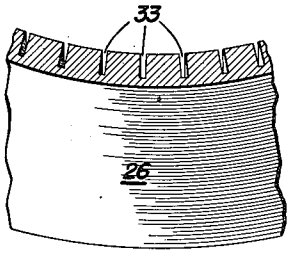
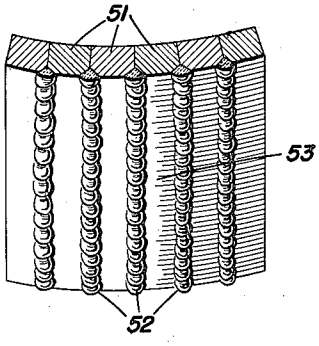


FIG. 7.



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ROD TYPE EXPLOSIVE WARHEAD

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2 Claims. (Cl. 102—68)

The present invention relates to an explosive projectile and more particularly to a warhead to be employed in a high speed guided missile.

Heretofore, it has been the practice to construct anti-aircraft projectiles with casings which will rupture, upon explosion, into a myriad of small, irregularly shaped fragments. These fragments were scattered outwardly by the force of the explosion to cover a predetermined area about the exploding projectile and thereby damage or possibly destroy any aircraft present within that area. However, it has been found that the lethality of this type of fragmentation, wherein the fragments are small and unevenly distributed, is low, especially when applied against high speed aircraft or guided missiles.

It is, therefore, an object of the present invention to provide an explosive projectile which, when detonated, will form a uniform fragmentation pattern of high lethality.

Another object of the invention is to provide an explosive projectile which upon detonation will form a uniform destructive cone composed of cleanly fractured, rod-shaped fragments.

It is a further object of this invention to provide a warhead embodying the above outlined features and adaptable for use in guided missiles.

Other objects and many of the attendant advantages of this invention will be appreciated readily as the same becomes understood by reference to the following detailed description, considered in connection with the accompanying drawings, wherein:

Fig. 1 is a sectional view, partly in elevation, showing the forward portion of a ramjet missile embodying a warhead constructed according to the present invention;

Fig. 2 is a perspective view of the warhead made in accordance with one embodiment of the present invention, the cover plate employed being partially removed to illustrate the internal structure;

Fig. 3 is a side elevation, partly in section, of the embodiment shown in Fig. 2;

Fig. 4 is a fragmentary elevation of the rear end of the warhead;

Fig. 5 is a fragmentary perspective view of the warhead casing;

Fig. 6 is a fragmentary sectional view, shown in perspective, of a modification of the invention; and

Fig. 7 is a fragmentary sectional view, shown in perspective, of another modification of the invention.

Referring now to Fig. 1, the forward portion 11 of a ramjet missile is shown, including an outer skin 12, an inner skin 13 defining a central duct 14, and an inner body 15 mounted coaxially in said duct by struts 16.

The forward end portion of the outer skin 12 is annularly cut away to define a recess 18, and flanged rings 19 and 21 are mounted in the missile between the outer skin 12 and the inner skin 13 to form the end walls of said recess. A warhead 22, constructed in accordance with the present invention and to be described more fully hereinafter, is mounted in the recess 18 and is secured in

any suitable manner, as by bolts (not shown), to the rings 19 and 21.

Referring now to Figs 2, 3 and 4, the warhead 22 is generally frusto-conical in shape, and is comprised of a casing including a pair of arcuate companion sections 23 and 24. These sections are each constituted by an inner wall 25 and an outer wall 26, defining inner and outer walls of a semi-annular housing or compartment 27, the purpose of which will be described hereinafter. The inner walls 25 are each formed at their lateral edges with flanges directed outwardly to provide side walls 28 and 29 for the sections 23 and 24, respectively. When said sections are assembled the side walls 28 of section 23 abut the corresponding side walls 29 of section 24. As best seen in Figs. 3 and 4, corresponding side walls 28 and 29 are depressed at their rear end portions to form opposed troughs defining a cylindrical recess 31 for receiving a firing squib 32 or other suitable explosion initiating element.

In order to attain the optimum effectiveness in warheads it is necessary to control the size and shape of the fragments upon detonation of said warhead. Fragment control is obtained by forming the warhead casing with stress lines or lines of weakness which determine the desired size and shape of fragments to be produced when said casing is fractured by detonation. A warhead that will produce rod-shaped fragments of substantially equal size, distributed in a uniform pattern about the exploding warhead, has been found to be more effective in damaging and destroying aircraft than any other type of fragmentation.

As best seen in Fig. 5, in order to insure that fragments of the desired rod shape will be produced upon warhead detonation, the inner surfaces of the walls 26 are provided with a plurality of stress lines in the form of equally spaced grooves 33, extending the full lengths of said walls and penetrating them to depths of one-half to three-fourths of their thicknesses. Upon explosion of the warhead, the walls 26 will fracture at the bases of the grooves 33, thereby producing clean-cut fragments of rod shape.

As shown in Figs. 2, 3 and 4, arcuate plates 34 and 35 are positioned at the rear ends of the sections 23 and 24 and are welded or otherwise suitably secured to the inner and outer walls 25 and 26 of said sections. The end edges 36 of the arcuate plate 34 abut the corresponding end edges 37 of the arcuate plate 35 to form an annular plate which closes the rear end of the compartment 27. The abutting pair of corresponding end edges 36 and 37 proximate to the recess 31 is formed with semi-circular cut-outs 38 and 39 to permit access to said housing for the insertion of the firing squib 32. A pair of arcuate cover plates 41 and 42 are positioned at the forward ends of the respective sections 23 and 24 and are bolted to semi-circular rings 43 and 44, mounted on the inner surfaces of the inner walls 25, and secured to the forward faces of the walls 26. However, prior to the installation of the cover plates 41 and 42, the compartments 27 of the companion sections 23 and 24 are filled with an explosive charge 45.

There are many ways of providing lines of weakness in the outer wall, other than as described above. The modifications illustrated in Figs. 6 and 7 show alternate casing designs which would also be effective.

The modification illustrated in Fig. 6 comprises a series of rod-shaped members 46 of generally rectangular cross-section, accurately machined to present smooth abutting faces 47 and a frusto-conical wall when said rod-shaped members are assembled with said faces in abutment. A thin, frangible, external covering 48 surrounds the assembled members and is spot welded, as shown at 49, to each member 46, thus holding them in place. When the explosive charge in the warhead is detonated, the forces

created will fracture the covering **48**, proximate to the junctures of the rod-shaped members **46**, thereby releasing said members for distribution in a uniform pattern about the exploding warhead.

The modification depicted in Fig. 7 is quite similar to the one illustrated in Fig. 6, in that a series of machined rod-shaped members **51** are assembled to form a frusto-conical casing. However, the members **51** are held in their frusto-conical assembly by soldering or welding along the junctures of adjacent members, as shown at **52**, thus furnishing a completely closed external surface **53**. As in the previously described modifications, this casing would also fracture at its weakest points, which in the present instance, would be at the welds **52**, thereby releasing the members **51** for uniform projection from the exploding warhead.

In operation, when a target is within range, the firing squib **32** in the recess **31** is caused to detonate and thus initiate the explosion of said warhead. Upon explosion, the casing **26** fractures into rod-shaped fragments which are projected outwardly and forwardly at extremely high velocities and in a conical pattern about the forward end of the missile. The rod-shaped fragments, by virtue of their shape and uniform distribution in a conical pattern, establish a lethal area within which no aircraft would escape serious damage or total destruction.

Obviously many embodiments other than those shown and described are possible without digressing from the teachings of the invention defined in the appended claims. Therefore, the foregoing detailed description is to be construed only as illustrative of this invention and not as limiting upon the appended claims.

What is claimed is:

1. A missile warhead comprising a pair of arcuate companion sections, each of said sections having a straight inner wall and an outer wall parallel with said inner wall for defining a compartment having a semi-annular cross-section, said inner walls being provided with flanges forming side walls for said compartments, said outer walls being formed of rod-shaped members welded together along their lengths, annular rings for retaining said companion sections in assembled relationship with the flanges of each section in abutment with the flanges of the other sections, and an explosive charge within the compartment of each section, detonation of said explosive charge causing fracture of said outer wall into rod shaped fragments.

2. A missile warhead comprising, a pair of arcuate companion sections, each of said sections having a straight inner wall and an outer wall parallel with said inner wall for defining a compartment semi-annular in cross section, said inner walls having flanges to form side walls for said compartments, said outer walls being formed of interconnected rod-shaped members, annular rings for retaining said companion sections in assembled relationship with the flanges of each section in abutment with the flanges of the adjacent section, said abutting flanges being shaped to define a recess to receive firing means, firing means in the recess, and an explosive charge within the compartment of each section, detonation of said explosive charge causing fracture of said outer wall into rod-shaped fragments.

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